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BUILDING UP PASTURES IN THE SOUTH

SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

New methods in agriculture require new tools. With speed and thoroughness which match those of defense-stimulated industry, the American farm plant is being retooled for soil and water conservation. The progress in mechanical techniques is charted by Harry L. Carr and G. E. Ryerson, beginning on page 113.

UNITED STATES DEPARTMENT OF AGRICULTURE – WASHINGTON

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SOIL CONSERVATION

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Moldboard remodeled by SCS for contour furrowing, 22-inch blade. There is a power-lift damming attachment at the rear of the plow.

Tooling Up for Soil Conservation

By HARRY L. CARR and G. E. RYERSON [1]

DURING the last year or two, American industry has been feverishly engaged in "tooling up" for the production of military material. Machines must be designed, built, and put in place for making the parts that go into guns, planes, tanks, and all the other articles of war. It is vital business, and the success of our national defense depends on the speed and efficiency with which the job is done.

With less fanfare and publicity, but with matching speed and thoroughness, the American farm plant is also being tooled up—tooled up for soil and water conservation. The process has been going on for several years; lately it has speeded up, paralleling in intensity the mounting enthusiasm among farmers for farmland improvement.

New methods in agriculture require new tools, because the farmer depends upon his implements and machinery no less than does the factory. As progress in soil conservation techniques has brought changes in agricultural practices, farm equipment men have developed new machines and altered old ones to meet the new demands. Experiment station experts and soil conservation technicians helped with ideas and inventions. And, as always, the American farmer made his own contributions to farm technology.

Most interesting, perhaps, of all the machinery and equipment recently developed in response to the demands of conservation farming are those for new methods of tillage, particularly for stubble mulch.

The stubble mulch system of cultivation has been called "the most promising conservation development in recent years." The term is applied to any process of protecting cultivated or bare land by the use of a complete or partial surface covering of crop residue or stubble. Most of the implements for this purpose provide for subsurface tillage without disturbing the surface litter. They range from a straight blade, drawn through the ground a few inches under the surface, to modifications of the duck-foot shovel, with the wings lengthened and mounted so that the cuts overlap.

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Orchard type disk harrow being used to disk kudzu vines in early spring, stimulating growth.

Tree planting machine developed and built by the Service to be used in establishing windbreaks.

The old rod weeder has come out in a new guise, with a modified duckfoot shovel that rides in front of the rod, permitting use of the machine in hard ground. Another machine, a sort of hybrid of the field cultivator and chisel equipped with bull-tongue shovels, loosens the soil without covering the surface litter.

All these implements are being built strong enough and with sufficient clearance to work in unplowed ground without clogging.

Other subsurface tillage machines of the shovel type are being built for row crop cultivation. Disks

Close-up of terracing attachment on tractor.

are being used to prevent covering of the crop. The conventional moldboard plow has undergone major operations to enable it to perform its usual operations without unduly covering the surface litter. The disk harrow has also been revamped—the curvature of the disks is made shallower so that it does not throw soil over the surface residue.

Another machine has been developed that gathers up trash in front of the tractor and blows it over the ground after the plow has passed, thus permitting a conventional plowing job while maintaining the cover of plant litter. A new mulcher, fed through a hopper, distributes any type of mulch in uniform layers over crop rows. In a few areas a rotary subsoiler is being used, which breaks up the soil without materially altering the surface layer.

Other tillage implements designed for conservation of soil and water are the various damming and basin-forming machines. Damming attachments are being manufactured by most of the implement companies for use with their conventional listers, and basin-forming attachments are sold for use with practically

Home-made sodding equipment.

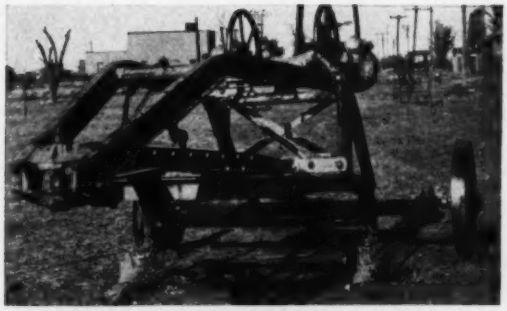
all types of farm tillage machinery. There is even a basin-forming chisel. Soil conservation men have also developed a machine to form dams in furrows left by corn cultivators.

Implements for surface tillage have not escaped the attention of conservation-minded inventors. Subsoiling attachments for conventional plows are gaining in popularity. A rotary hoe attachment on a row crop cultivator has proved helpful, not only for weed control, but in eliminating the furrows left by the cultivator. Operated backwards, it will work in trashy cover without picking up litter and clogging. A special machine has been developed for cultivating kudzu.

Use of the two-way plow is spreading rapidly. Several manufacturers are making mounted types, while nearly all make the trail type.

To meet the increasing needs for machinery for planting and seeding, especially in the field of cover crops, American inventiveness has furnished a number of new devices. There are cyclone seeders for attaching to corn cultivators, to permit the seeding of cover crops at the time of the last cultivation. Similar attachments for cultipackers aid in the establishment of crimson clover. Other machines simplify and speed up the establishment of sod. Various stationary shakers and attachments for moldboard plows reduce the cost of harvesting Bermuda sod for transplanting. Complementing these machines are devices consisting of furrow openers, hoppers for the Bermuda roots, and chutes for dropping the sprigs in the furrow. Covering devices follow, sometimes with press wheels.

The opener type double disk coulter, further improved, has come into wider use for native and tame grasses as well as small grains and in all types of mulch.



Two-row contour furrowing machine.

Lespedeza combine attachment. Note straw residue.

Modifications in grain drills have improved their covering ability and minimized clogging troubles while operating in trashy cover. A grass seeder has been adapted for use in conjunction with the blocking lister. The field scale planting of kudzu has been greatly facilitated by the development of a special kudzu planter, and large-scale tree planting is made easier and cheaper by a newly perfected machine.

Among farmers who object to drilled corn in contour operations, hill-dropping attachments are increasing in general use. Potato planters have been modified to permit effective operation on the contour. This modification permits more accurate control of depth and the relationship between seed and fertilizer placements.

The spread of conservation farming has also had its effect on harvesting equipment. The development of small combines has removed much of the difficulty of harvesting small, irregularly shaped fields. A pusher-type mower has been developed that will work in narrow spaces in orchards inaccessible with conventional offset mowers. Potato diggers have been altered so that the bed can be kept level while the machine is

Kudzu digger adapted from Killefer tree digger.

traveling on the contour, thus preventing crowding and bruising of the potatoes.

Combines have been equipped with straw spreaders to protect the soil and add organic matter.

For harvesting soil-building and soil-conserving crops there are devices for lifting kudzu crowns, cutter bar attachments to permit mowing of kudzu, mower and combine attachments for collecting lespedeza seed, and other equipment for harvesting the seeds of native grasses—formerly very expensive and difficult to collect.

The gradual advance of terracing from the South to all other sections of the country has brought with it new, simpler, and better terracing machines. Some are heavy and large, for the professional terracer; others are designed for use by farmers. Among contractors and cooperatives, the road maintainer or auto patrol has become popular for terrace building because of its one-man power-operated controls and self-propulsion on the highway.

For farmer use there is a combination plow-terracer consisting of a conventional plow bottom delivering its furrow slice to a standard terracer moldboard. Small farm tractors have been equipped with power-controlled disks which show great promise in terrace construction. The "whirlwind" terracer is now available in a reversible model. The small elevating grader type terracer has been made better and cheaper.

Significant advances have been made in adapting ordinary equipment to terrace building. Good terraces are being constructed with slip scrapers, rotary scrapers and fresnos at very slight cost. The standard orchard disk harrow has been used successfully to build up terraces in orchards by repeated disking. Other commercially manufactured terracers have been modified and improved to keep pace with rapidly increasing knowledge of this important soil-conserving measure.

Earth-moving equipment has been made available to farmers by means of small wheel-type scrapers for use with the ordinary farm tractor. Such machines enable farmers and ranchers to construct ponds, water storage dugouts, diversion ditches, and other earthworks. Crescent scoops used with double-drum tractor-mounted winches are also employed in farm pond building and similar work. Truck excavators have proved valuable in cleaning, deepening, and widening drainage ditches too small for dragline operation.

Contour furrowing machines of many types have been developed, most of them modifications of con-

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Pasture Development in the South

By R. H. LUSH [1]

RIGHT now we are in the midst of a program for bettering human nutrition and increasing food for defense. Research has shown that the quality of milk and eggs, and more recently of beef also, depends on the feed the animals consume. Better nutrition should start at the grass roots, and it is going to take the combined efforts of the Soil Conservation Service, the Agricultural Extension Service, the Agricultural Adjustment Administration, and many other agricultural agencies to see that the grass roots are properly fed.

In 1939, nearly 5,800,000 farmers in the United States participated in conservation practices. These included application to the soil of nearly 5,800,000 tons of liming materials and about 636,000 tons of superphosphate, 16 percent equivalent. Probably not more than 390,000 tons of this superphosphate was placed on potential pastures or hayland. If this tonnage were applied to the pasture land, it would replace only one-tenth of the phosphorus removed by grazing. How much fertilizer has been purchased privately, outside Government grants-of-aid, for use on pastures to increase feed consumption, is difficult to determine. According to a consumer survey for 1938, about 2.8 percent of the plowable pasture of 23 States received an average of 230 pounds per acre of fertilizer. This is a good beginning but not nearly enough. It puts the pastures, as far as required plantfood is concerned, in the same position as an individual needing a minimum of 2,000 calories a day and receiving only 300 calories with no attention to protein, vitamin, or mineral requirements.

The depletion of fertility in pastures is constantly under way. Each pound of meat, each quart of milk, removes plantfood from the soil. An average cow will eat the equivalent of 2 tons of dry pasture grass during the grazing season, if available. That much feed removes from the soil 115 pounds of nitrogen, 26 pounds of phosphoric acid, 93 pounds of potash, and 37 pounds of calcium oxide. Even with conservation of the manure, one-half of the nitrogen and phosphorus and 30 percent of the potash may be lost to the pasture soil. With other classes of farm animals, the plantfood losses are somewhat less. Supplemental grain feeding tends to reduce the net losses in fertility, but in a program of pasture and roughage feeding we are not adding much fertility from that source.

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Beef cattle of high quality are increasing along with improved pastures in the South.

In the South we are confronted with the problem of putting some of the poorer crop land, particularly that recently in cotton, into pasture. But there must be enough fertility added to this soil to produce a root system that will hold and make use of manure later dropped on the pasture, else much of the labor and seed of pasture improvement will be lost.

Economical production of livestock in the South depends primarily on a liberal supply of home-grown feeds, chiefly pasture or other forms of forage. The supply of pasture is becoming more adequate, as shown by the Census figures. Excluding Texas and Oklahoma, the total acreage of plowable pasture in the other 12 Southern States has increased approximately 8,000,000 acres, or 42 percent, in the last decade. The increase in woodland pasture has been about 5,000,000 acres. Hence the total amount of pasture available for livestock grazing is now about 114,000,000 acres, or 13 percent, more than it was 10 years ago.

During this same period in these States there has been little change in the total number of horses or sheep, an 11-percent decrease in the number of mules, about 12-percent increase in cows milked, 26-percent increase in total cattle, and an increase of 44 percent in number of hogs. The total number of animal units in these 12 States is now nearly 12,000,000, or 13 percent higher than it was 10 years ago. This indicates that slightly less than 10 acres of pasture is available for each animal unit. Considering only the most valuable plowable pasture acreage, there are 2.3 acres available per animal unit. Much of the rest is of poor quality, or in woodland, and should continue to raise trees. There are, of course, other sources of forage supply such as field crops for grazing, forest land, and

Mares and colts on a fertilized pasture in Maryland.

waste land, but dependence upon this and two acres of ordinary plowable pasture is hardly adequate, according to accepted standards.

To depend entirely upon grazing of these pasture acres cannot give maximum production because of the variation in supply. Results in Louisiana, where pastures were clipped at monthly intervals for 8 years to determine yield, showed two distinct peaks of production. Sixteen percent of the total yearly production of dry matter was made during April; while 20 percent, the highest peak, was produced in August. However, the dry matter contained 20 percent protein in early spring, and less than 12 percent protein in late summer. Such fresh pasture may be looked upon as a "watered" 20 percent protein feed in early spring, and a 12 percent protein feed in late summer. Supplemental feeding of livestock, especially milk cows or hogs, should take into consideration this seasonal variation in pasture composition. The variation in yields of permanent pasture makes it imperative, for nearly all classes of livestock, that some additional feed be provided to give a uniform daily supply. This may be supplemental grazing crops, hay, or other feeds.

Experiments conducted in Virginia more than 30 years ago showed that superphosphate aided in the control of broomsedge and weeds by increasing the amount of clover. Within the past few years experiments in every State and thousands of demonstrations have shown farmers that pasture is one of the most important farm crops. It has been shown to be a crop that responds profitably to treatment, especially to the use of plantfood, lime, and good grazing management. Few livestock farmers have too much feed even in this day of surpluses, and it takes an ample feed supply to promote quick growth and meet the present market requirements of high quality at lower cost. Good pasture is the cheapest of all farm feeds for all classes of livestock. Pastures and other forage crops furnish more than 50 percent of all the nutrients fed to farm animals. In Missouri, for example, 65 to 75 percent of the farm income, exclusive of Government payments, comes from pasture farming. There is a significant relation between good pasture management, good livestock, and high farm income.

In spite of some of the South's natural advantages in livestock production and progress in pasture improvement, this region has not produced its proportionate share. The entire South, including Texas and Oklahoma, has 48 percent of the Nation's farms, 32 percent of the Nation's hogs, 30 percent of the Nation's cows and chickens, and only 28 percent of the Nation's sheep. But it has only 20 percent of the total cattle valuation. Delay in eradication of animal diseases, increasing difficulty with animal parasites, indifference to improvement in methods of breeding and marketing have all been retarding factors. A lack of appreciation of the quality of pasture and other forage feeds has resulted in livestock of low quality. Livestock in the bluegrass region of Kentucky and middle Tennessee, in the Shenandoah Valley of Virginia, and in certain other soil areas of the South are famous for their excellence. Animals thrive in those regions because the pastures contain plenty of all the nutrients essential to their welfare. In other areas animals thrive to the degree to which the soil has supplied the essential elements to the forages or other feeds. In earlier years when grain was relatively cheap, and especially when cottonseed meal was fed abundantly and soils were not quite so depleted, these differences were not so apparent.

When a surplus of pasture occurs in the spring, it can be economically utilized as hay or grass silage.

Ewes and lambs enjoy improved pasture at Raleigh, N. C.

The areas where phosphorus deficiency exists are now known to include the Gulf coast, a part of the Atlantic coast, the middle South, and the extreme Southwest. The more acid and sandy soils, particularly in the Coastal section, may provide insufficient calcium, iron, copper, and cobalt, as well as insufficient phosphorus to the pastures grown in these areas. Manganese, while lacking in some rations for poultry and pigs, apparently is not generally deficient; neither is magnesium apt to be lacking in the ordinary farm ration. There is apparently no shortage of iodine in forages of the South; while sodium and chlorine, in the form of common salt, are generally supplied to all classes of livestock. Although boron, potassium, sulphur, and zinc have been proved necessary for crop production, they are not deficient in the ordinary rations fed to farm livestock. Neither is there any evidence in the South of an excess of selenium, which sometimes occurs in the Great Plains area, or of fluorine.

Where crop and pasture land are so managed and fertilized that an abundance of palatable and nutritious forage is produced for as many days in the year as possible, there will be little need by livestock for any mineral supplements other than common salt. Nor is there apt to be a shortage of any known vitamins if these good practices are followed.

Grass is called a perfect food. Very tender grass contains 23 times as much vitamin A as carrots, 22 times as much vitamin B_2 as lettuce, 9 times as much B_1 as green leafy vegetables, and 14 times as much C as tomatoes and citrus fruit. About 12 pounds of dried tender grass would supply enough vitamins to last a man for an entire year.

But all that grows in pastures will not have the nutritive value described above. Early reports showed that legumes in general contained more calcium and protein and were considered of higher value for feeding than grasses. Recent reports show, however, that the same variety of legumes, grown on different soils, may give different results when fed to farm animals. This is being demonstrated by work at the Tennessee Experiment Station where red clover grown on fertile soil when fed to beef calves gave nearly twice the rate of gain as red clover grown on unfertile soil. Grasses grown on fertile soils may have higher feeding value per unit of dry matter than even legumes raised on poor land. Fertile alluvial land pasture in Louisiana produced an average of 5,068 pounds total digestible nutrients per acre, or the feed equivalent of 93 bushels of ear corn, 14½ tons of corn and soybean silage, and the equivalent in protein of 3,272 pounds of 41-percent cottonseed meal. Unfertilized but properly seeded flatwoods pasture, 50 miles away, produced only one-third as much dry matter, one-fourth as much total digestible nutrients, one-fifth as much calcium, and one-twelfth as much phosphorus per acre. Soil may influence quality to a greater extent than can at present be determined by chemical analyses.

Phosphorus applications at Holly Springs, Miss., resulted in almost twice as many pounds per acre of pasture forage that was richer in crude protein by 20

Well fertilized oats can be grazed during the winter and early spring, and still produce a good hay crop, as shown here at Willard, N. C.

percent and was grazed by the cattle in preference to unfertilized plots.

Fertilized pastures on one Virginia soil contained up to 39 percent more crude protein and 47 percent more phosphorus than untreated pastures.

The Kentucky Experiment Station found that lespedeza grown on certain limestone soils contained 0.32 percent of phosphorus and 1.28 percent of calcium; but when grown on soils outside the limestone area it contained only 0.14 percent of phosphorus and 0.89 percent of calcium.

Thus the effects on the animals using the pastures may be even greater than indicated by mere increase in yields of dry matter. Growth, development, reproduction, lactation, health, and soundness—all can be influenced to a marked degree by deficiencies or unbalances of the mineral content of the feed supply.

In Georgia, beef cows on permanent clover pastures treated with limestone and phosphate produced a 100-percent calf crop two years in succession. Only 50 percent of the cows on native unfertilized pasture produced calves. Steers gained 165 percent more per acre on improved pasture than on native unfertilized pasture. The finish and grade of the steers on improved pasture was also higher at the end of the grazing season. In more recent work, young mules on pasture treated with calcium and phosphorus gained 23 percent more in growth than mules on untreated pasture.

From every State come reports of preferential grazing of livestock on improved pastures. Even a blind horse in Ohio always found his way to the improved part of the pasture. Perhaps because the animals continually ate up the evidence of increased growth, we, too, have been blind to the differences in quality.

Dr. W. A. Albrecht, of the Univerity of Missouri, stated recently: "That sick soils will not make healthy animals is particularly significant at this time. We are thinking on a national scale of combating soil erosion by allowing much of the fertility-depleted soil to go back to grass. In our desperate search for varieties of plants that will exist on such soils, perhaps we have given too little thought to whether the forage so grown would be put by the cow on her list of dietary delicacies. Attention to the evidence of soil deficiencies as given by the dumb animals will react with profit both individually and nationally."

If continued progress toward grassland farming is to be made, we must change the old slogan, "Let more land go to grass," to the more logical one, "Help the land to grow more nutritious grass."

It has been said that the best kind of pasture is the half-acre you don't need. The best time to start a new pasture is nearly a year before it is to be used.

We need more effective use of farm pastures in all parts of the South to meet rising feed prices, increased dairy and livestock products for home market demands, and to fit into long-time crop rotations for stabilizing production after the war is over. It is late but not too late. At least one-half acre per animal of an adapted winter grain crop should be planted to furnish much needed grazing, to hold the soil against erosion during the winter, and to provide badly needed early pasture or hay.

In South Carolina records show that feed costs have been reduced one-third to one-half in winter in herds where winter grazing was available, but it takes suitable soil with sufficient available plant food, as well as early planting and cold-resistant crops, to supply better grazing.

Fall is the best time to fertilize permanent pastures in the South. It provides earlier spring grazing, enables grass to withstand winter conditions, saves feed cost, and better distributes farm costs. This year in particular, early fall delivery of fertilizer will avoid some of the later freight congestion that will occur as a result of defense activities. The Agricultural Conservation Program has made it possible for the farmer to apply lime and superphosphate very economically. Many pastures, however, are past the first stages of soil exhaustion and are now deficient in organic matter, nitrogen, potash, and lime. Complete fertilizer recommended by the State agricultural experiment station for the particular soil type may be profitable, where lime and superphosphate alone give only fair results. It is time to make judicious application of fertilizer to pastures to fit into the southern program of more feed production for livestock. Few farmers have too much pasture or too-well-fed livestock. When hungry grasslands are fed, livestock will thrive and there will be fewer hungry farm people.

Chris Olsen.

Chris Olsen, Montana Farmer

By WILLIAM C. PRYOR [1]

A MAN learns something from almost everything he does—if he uses his head. Chris Olsen of Montana uses his head. You might not think the experience a man could pick up as a machinist or an oiler on an ocean freighter would be particularly useful on a farm. But it made a good mechanic of Chris Olsen, and now he is able to keep all his farm machinery in first-class shape without help. It takes quite a lot of machinery to farm 480 acres.

Olsen used his head other ways, too. Last year he made a down payment to buy the 480 acres he had been renting for 13 years, and he did not have to put himself "in hock" to do it. He made this money selling crested-wheatgrass seed harvested from the buffer strips in his wheatfields.

That comes pretty close to eating your cake and having it too, because while the buffer strips were producing seed they were also protecting the fields from erosion and growing a good crop of palatable hay. The hay helped Olsen to winter his cattle—25 head of beef cattle and a half-dozen or so dairy animals—practically without cost.

Naturally, Chris is "all out" for conservation farming, although there was a time when his enthusiasm was not as wholehearted as it is now—the time a "gully-buster" came whooping down across the Canadian line and washed out some of his new terraces, and the wheat crop with them.

As they tell it out at Culbertson, headquarters of the Froid Demonstration Project and Froid Soil Conservation District, some of the boys from the project office hurried out to Olsen's place the morning after this storm to have a look.

Chris met them at the gate with a black scowl on his face. Through some miscalculation, the rain had sluiced terraces and wheat down to the foot of the slope. Chris was perturbed.

Soon, however, after he had thought it over, he agreed to a revamping of the plans to guard against a repetition of the terrace-washing. Work was begun then on the new farm conservation plan that has resulted in the auspicious evidence visible today.

Chris Olsen is a Dane, and smart. Several years as a machinist in his native Denmark and as oiler on a cargo ship had convinced him that above all things he wanted to be a farmer. Shortly after World War I he came to America to try it out.

About 13 years ago he moved onto the land he is buying now, renting it from an absentee landlord. Naturally, he had the same troubles that other farmers in northeastern Montana had—some washing, considerable wind erosion at times, dry spells. Most of the farm was in wheat, which didn't help. The landlord insisted on this, because like most absentee landlords he wanted to make as much as possible off the land, regardless of what happened to the soil.

As conservation began to be talked about, Olsen became interested. He could see the topsoil blowing away and knew that something ought to be done about it. Then finally along came the Soil Conservation Service, establishing demonstration projects. One was set up in Roosevelt County, around the town of

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Froid, and Olsen's 480 acres were included. He signed up as a cooperator.

The experience with the heavy rain that washed out the terraces proved a set-back, but only a slight one. Quickly Olsen became as enthusiastic about conservation measures as the boys at the project office. He began to see with his own eyes the amazing results, both in protection of the soil, and in its improvement.

Numerous practices suitable to the northeastern Montana country were applied to the place. He planted a windbreak to protect his house and outbuildings—fine, thrifty trees and shrubs, in a country where such things cost a dollar a leaf; he plowed contour furrows in the pasture lands; he built a stock water pond; and, of course, he established those crested-wheatgrass buffer strips.

Olsen is a thorough believer in conservation, and the day I went to his farm with Art Emerson, information director of the Northern Great Plains Region, and "Hil" Riek, the district conservationist, the welcome we received was vastly different from the one he gave the project men the morning after the "gully-buster." "Hil" and Chris are close friends and have been for some time.

Chris is a little shy, but the warmth of his greeting was unmistakable. When we reached the place, he was pruning the trees in the windbreak of which he is so proud. He kept right on working, although at times he raised his head to give us quick glances from under his big straw hat. Chris is never loquacious, but what he lacks in volubility he makes up in sincerity.

When he looked at us and said solemnly, "Soil conservation? I think it's wonderful!" it was apparent that he meant what he said. He had tried hard to get conservation measures applied throughout the farm, using the theory that more of the land should be in grass and less in wheat; but the landlord was interested in cash crops, and held out for a good percentage of the acreage in wheat.

Finally Olsen began to entertain thoughts of buying the place so that he could farm it his own way. He knew that it takes more than thoughts to buy a 480-acre farm—it takes money— and then one day his eye came to a stop on the crested-wheatgrass buffer strips which the landlord had agreed to in order to reduce wind erosion. The heads of seed were beginning to develop. The big idea was born. The buffer strips had a good stand of wheatgrass and would produce a considerable amount of seed. He knew that this grass was being "pushed" in conservation work throughout the region. There probably was a market, Olsen thought, for a lot of the seed. So he set to work.

He knew that it would be necessary to clean the seed, and it was here that he brought into play his mechanical skill to add a few refinements to his combine. When the seed was ripe he harvested it and ran it through the combine to clean it.

That first year his total yield of seed was 400 pounds per acre. In 1940 he harvested and sold 11,000 pounds.

Nor did he sell the whole lot to a dealer or a seed company. He sold it at retail direct to the users—his farmer neighbors. The cleaned seed was sacked and loaded into his wagon, and he set out—a house-to-house salesman of crested-wheatgrass seed.

He well knew that not all of the farmers in northeastern Montana were convinced, as he himself was, of the value of crested wheatgrass as a soil-holder. But he was ready for them—he took along evidence. On the seat beside him was a fresh green plant of the wheatgrass to show what excellent green forage it made, with some wheatgrass hay to show how good it was as winter forage. Finally, he carried a whole clump of crested wheatgrass, roots and all, to show the farmers how admirably fitted it was to hold the soil in place.

He sold the seed. Occasionally some skeptic would claim that the exhibits were handpicked from special plots rather than at random from the fields. Chris always invited these doubters to his farm and took them out to the fields and pulled up a few clumps. Generally, they were convinced.

Within a few weeks Chris Olsen walked into the bank with the money for the down payment, and began farming his 480 acres his own way.

His own way is a little different from that of many farmers in his neighborhood. For instance, Chris states flatly that every farmer in that section of the country should have one-third of his land in grass at all times. That is what he is working toward on his own farm.

Olsen says that there has been no blowing of soil on his farm in the five years since he started applying conservation practices to the land, which means since the demonstration project was established, and he intends to continue contour and straight strip-cropping.

The rotation now established will be followed, leaving part of the land in grass for 5 years and then plowing it up, but never plowing up the established grass until the new grass plots in the rotation are started.

Already he has decided on a few changes in field

layouts to improve operations; but he indicated that these changes would wait until it was time to make the change under his normal rotation plan. Chris considers it extremely important that each acre of land should be in grass 5 years out of every 15.

Crested wheatgrass and wheat are not the only crops Olsen grows. Under his flood irrigation system he has four acres of alfalfa that has been yielding about 5 tons of hay per year. As for hay, that same crested wheatgrass is good, too, when cut at the right time—"about as satisfactory as alfalfa hay," he declared.

He has a stack of wheatgrass hay about as long as a city block, which has proved a blessing during the winter months for feeding the stock. In addition to this hay, his stock was given winter grazing on the crested wheatgrass growing in a field adjoining the barns, and they came through the cold months in fine shape.

For that matter, he grazed his crested wheatgrass during spring and autumn too. Crested wheatgrass pasture has a carrying capacity of a cow and a calf per acre in early spring and late autumn, and Olsen used his that way for a total of 5 months in the year.

No wonder Chris likes crested wheatgrass, and no wonder he is now reserving a special plot on the place where he will grow wheatgrass seed. This will afford him a permanent source of seed without interfering with his rotation of 5 years out of 15 in grass.

No wonder that Chris Olsen is pleased with conservation farming. It has enabled him to build up a reserve feed supply on a farm that would be the envy of almost any farmer—enough to feed his stock, his chickens and his turkeys. Not just for a few weeks, but, as he himself expressed it, "Even if the wheat should fail, we're fixed now so that we could get along all right for a year or two."

Chris Olsen is pleased, but he is not satisfied. He still is looking for a better way to do things—for instance, a better way to grow wheat and barley, or to put it the other way 'round, a way to grow better wheat and barley.

During the last few years he has been conducting some unusual and carefully planned experiments along this line. First the barley: He planted it in rows 24 inches apart and cultivated it, instead of drilling it in. The results were worth while, he thinks. The barley from the wide-row fields which he has stored in his bins is almost like wheat with its full kernels and heavy weight, and Olsen likes to show it to visitors and compare it with barley grown the old way—a sack of which he keeps for such demonstrations.

Now for the wheat. It was somewhat dry in northeastern Montana 2 years ago, but Chris found

Crested wheatgrass is the No. 1 grass for fat cattle and safe soil in Prairie County.

that the wheat planted in rows 24 inches apart, and cultivated, yielded 18 bushels of No. 1 wheat per acre; while wheat drilled in the ordinary way yielded only 11 bushels of No. 3 wheat to the acre.

Chris is not one to jump at conclusions. Asked if he was going to continue the practice, he looked thoughtful. "I want to do some more testing before I make up my mind about the wheat," he said. Chris is too smart to pass up any opportunities and too intelligent to make flash decisions.

(*Continued on p. 126*)

Conservation Practices Receive Approval of Bankers

Bankers are practical people. They do not jump at conclusions, do not take to fads or new ideas unless they see dollars-and-cents values—if they did they would not long be bankers. From the stacks of letters reaching the Service yearly, these from bankers in various parts of the country are quoted as definitely indicative of the monetary value of soil and water conservation methods. In a way, these statements constitute an important message to the farmer from the banker, by way of the Soil Conservation Service.—Editor's Note.

The cashier of the Springfield State Bank, Springfield, S. Dak., writes to the directors of the Emanuel-Choteau Creek Soil Conservation District:

One of your cooperators came to us for a loan on his corn crop. The writer personally has watched this field with much interest. His crop had been farmed on the contour. As we knew that he would harvest a good yield, we made the loan and after harvest it was paid in full. We found that this gentleman had a yield of over 20 bushels of corn more than any of his neighbors.

During these past 10 years of extremely dry weather, practices of saving the soil and conservation of land have been most important. From the standpoint of the banker, I regret that your soil office was not with us during all of those 10 years. However, I feel that you are now doing a great work along conservation lines; your soil survey of this area will be most valuable in the years to come. Your practices have aided the credit of our farmers.

Elvin C. Bjorklund, District Conservationist of the Sioux-Brule Soil Conservation District, Alcester, S. Dak., received a letter quoted in part from E. F. McKillips, cashier, State Bank of Alcester:

You will recall that we mentioned to you about 2 weeks ago a favorable experience in connection with an unimproved 80 acres which you have placed under a complete soil conservation program. We thought perhaps you would like this information in your files.

This bank, as you know, makes real-estate loans for life-insurance companies. We had a customer who desired to buy the 160 acres that he was renting, at a cost of $12,000. In order to make this purchase, it was necessary for him to float a real-estate loan for $10,500 on the improved 160 acres which he was purchasing and the unimproved 80 which he owned.

The outside limit which this man could borrow on the 160 acres was $8,000, and the inspector for the loan company would agree to this amount only on a condition that certain soil conservation practices be established on this farm, including the building of a dam.

The 80 acres had to carry a loan of $2,500. This is a rough farm with a creek running the whole length, and under ordinary farming practices it would not be eligible for a real-estate loan of any kind. However, because this eighty could be tied in with the 160 acres with homestead already established, and because of the soil conservation practices in use on the smaller area, the loan company inspector agreed to a $2,500 loan, which gave the man the desired loan of $10,500 on the whole 240 acres.

The water control on the eighty, consisting of a well-constructed dam, contour farming and crop practices saved the day for this farmer.

This statement by D. F. Patterson, cashier of Palmetto Bank, Laurens, S. C., comes from the files of T. S. Buie, Regional Conservator, Southeastern Region, Soil Conservation Service.

Since we are located in an agricultural county we feel that it is our responsibility to finance the farmers of the surrounding territory. Applications for loans come from all types of farmers—successful, fair, and those on the border line. In approving agricultural loans we must make an appraisal of the character, ability, and capacity of the farmer. Many farmers do not have the highest rating on all three requisites, and other factors need consideration. One of the finest recommendations for a farmer is the presentation to us of a well-planned soil conservation plan and reasonable assurance that it will be carried out on the particular farm. This farmer can be granted credit where another farmer under similar circumstances but without a conservation plan could not receive the same assistance. From our experience we have found that the loan to the farmer who carries out a well-planned conservation plan has the least element of risk.

J. B. Barnett, president of the Monroe County Bank, Monroeville, Ala., writes of his county's farms in a letter to Regional Conservator Buie:

I have observed with considerable interest the splendid work that you are doing in this county to conserve and improve our soils.

The three banks in Monroe County of which I am president have a deep interest in any movement or program that looks to the rehabilitation of our worn and washed off land, and as these banks do a major part of their business with farmers, we are at all times willing and anxious to extend credit and a helping hand in any program that will enable our customers to improve their farms because it enhances their value and increases the income derived therefrom.

I trust that you may be permitted to carry on your work in our county for a long time, and that the CCC will be able to prolong their stay in our midst and carry on this work until our farmers learn to put into practice the things you and your associates are teaching them and demonstrating to them.

This county has been almost entirely an agricultural county since it was first settled something like 150 years ago, and in the future as well as in the past it will be necessary for our people to look for their prosperity in enriched soil and better farming practices.

This statement was made by J. Worth Morgan, manager, Forest City Branch, Union Trust Co., Forest City, N. C.:

In our hilly Piedmont country, the first requisite in building a rich, productive soil is the proper use of soil conservation practices. It is folly for a farmer to buy expensive fertilizer or endeavor to enrich his soil by the growing of legume crops, unless he first conserves his soil. With the aid given the Soil Conservation Districts by the United States Department of Agriculture it is now possible for all of our farmers to have their farms planned so that the soil and moisture losses will be reduced to a minimum.

Soil conservation cannot very well be valued in dollars and cents. One must look out into future years, as the land regains fertility, produces bigger crops and higher farm income with less work and expense.

The banker is especially interested in soil conservation because he realizes that agriculture is the very backbone of all industry. Business is always good in the city or town surrounded by a rich agricultural community. The farmer who conserves his soil always finds credit more easily obtainable from the bank than his neighbor who permits his valuable soil to wash away.

Adam Lockhart, cashier of the Bank of Wadesboro, N. C., is also an active cooperator of the Brown Creek Soil Conservation District with headquarters at Wadesboro. Conservation plans have already been developed for three of Mr. Lockhart's farms in Anson County, covering 2,880 acres, and he has applied for a conservation plan on another farm embracing approximately 1,000 acres. He is a breeder of purebred Hereford and Jersey cattle, and in addition to crops for feeding livestock and improving the soil, he raises about 300 acres of cotton each year.

As a banker vitally interested in the welfare of agriculture, Mr. Lockhart says:

We consider a district cooperator a much better credit risk than he would be were he not a cooperator; and the closer he cooperates in carrying out his plan, the better credit risk he is.

Farmers do not give enough attention to investing for the future and building for permanency. So many steal from themselves by spending money for nonessentials that should be spent in improving their farms. Money spent to improve and conserve the land is always a safe and sound investment for the future.

I consider the development of permanent pastures and hay crops as especially desirable from an investment standpoint since returns are paid over a long period of years and the soil is conserved during the time.

L. M. Grimes is vice president of both the Industrial Bank of Lexington and the Commercial Bank of Lexington, N. C. In addition, he operates a large roller mill and a feed and fertilizer business. Daily he meets farmers and talks with them.

Speaking of soil conservation, Mr. Grimes said, "Many farms were washing away and this brought about lower crop yields and lower land values. There was need for a program that would control this erosion, help to build up the farms, and make more money for the farmers. I believe that the type of work done by the Soil Conservation Service is needed and that it is money well spent.

"Naturally a banker would prefer to loan money to a farmer who was trying to build up his farm and keep it from washing away."

Mr. Grimes stated that farms with a large amount of idle land are not very good risks for loans. "The idle land should be put to work," said Mr. Grimes. "Where there is very much idle land on a farm everything is going out and nothing is coming in. A man can't pay back a loan on this type of land and I would not recommend much of a loan on farms like this."

B. Datin, vice president of the Farmers State Bank, Faith, S. Dak., apparently is one of those bankers who keep up to the minute on soil and water conservation practices. He writes to I. T. Hermanson, district conservationist for his area, as follows:

In 1934 and 1936, we experienced very severe droughts. At that time quite a number of our customers depended entirely on open water for their livestock. During those 2 years, in different parts of our territory the water holes dried up and creeks went dry, and as a result considerable livestock had to be shipped out of the country.

At this time we have around 300 dams that we did not have in 1934 and 1936, and regardless of the severity of any drought we might have in the future, we feel that these dams are going to furnish all the stock water we need. Naturally we feel that our range loans are much safer than before these dams were built.

Also we believe that the spreader systems constructed here will greatly increase hay production and enhance the value of the ranches on which they are built.

J. H. Morgan is vice president of the Opelika National Bank, Opelika, Ala., and chairman of the agricultural committee, Alabama Bankers' Association. He visits farms, talks with farmers, sends us this statement:

I recently visited some of the farms in south Alabama that were planned by representatives of the Soil Conservation Service. I found in effect on these farms programs that will conserve the soil, establish permanent farming systems, produce more food and feed and thereby raise the standard of living of the farmers. These plans, or the method of farming outlined in them, offer the brightest ray of hope I see in the present agricultural outlook: they offer the farmer a chance to get away from the one-crop system that has been such a curse to the South.

Since my trip I have talked with numbers of farmers and bankers about the program of the Soil Conservation Service and they invariably were enthusiastic about it.

It is my opinion that if farmers will carry out the type of plans made by the Soil Conservation Service their income will be doubled or tripled in 5 years.

I would consider a farmer who is carrying out one of the plans on his farm, or practices similar to those generally recommended in the plans, a 50 percent better credit risk than one who is following our old one-crop system. I would further consider him a good credit risk because he has a definite plan and a goal toward which he is working. This goal will in the end mean better land, more and better livestock with increased farm income. I like the plans because they are made with the farmers for their individual farms.

The district approach to the conservation of our soil appeals to me because it stimulates the interest of the farmers and makes them feel that they are a part of the conservation program.

On my trip to south Alabama I saw many acres planted to kudzu and sericea lespedeza. If the hundreds of thousands of acres of idle land in Alabama were planted to these crops it would mean a tremendous financial uplift to the farmers of the State.

It is our intention, as the agricultural committee of the Alabama Bankers' Association, to build our program around soil conservation. We believe that the bankers have a place in this program along with the farmers.

W. D. Malone is president of the First National Bank of Dothan, Ala., and past chairman, agricultural committee, Alabama State Bankers' Association. He knows that the future of his 40-year-old bank is dependent upon the productivity of the farm land of his community. He sends us the following letter:

This bank recently employed a man whose sole work is to encourage better farm management and methods among our customers. We often send him out to make a survey before we pass on an agricultural loan. The first question we ask him is "How is that farmer keeping up his place—the land as well as the buildings?" We want

to know about terraces, the quality of the soil, and if we can reasonably expect that soil to maintain its fertility over the period of a 5- or 10-year loan.

We realize that a tremendous amount of energy, earnest endeavor and personal interest in an organized way is going to be necessary to handle soil conservation properly. Our observation is that soil conservation is often a community's problem rather than a problem for one particular man's farm. We are much impressed with the start that has been made in our particular section and community in respect to what we know as the "districts movement." The problem cannot be solved independently or individually, but is going to take much cooperation and scientific planning.

CHRIS OLSEN, MONTANA FARMER

(Continued from p. 123)

This intelligence carries over into every phase of his farm work. I have seen—and so have you—many a farm where the machinery sits out in the barnyard or by the side of a field, rain or shine, and receives little or no care. Not on the Olsen place. Chris gives every piece of machinery on the place a thorough going over at least once every other year—oftener if necessary. As he is an experienced mechanic he can do it, and he has a heated building spacious enough to permit work on all his machinery during the winter months when outdoor work is slack.

His farm machinery is Chris Olsen's weakness, if he has one. Sometimes he will guide the visitor to a long row of farm machines of various types lined up against a fence near the house, his own private outdoor museum of farm equipment.

"That is my first walking plow," he will point out. "And my first sulky plow, and my first gang plow."—and so on, down to the end of the line. These machines, no longer used, are kept as mementos of his farming progress.

Mrs. Olsen has no objections. She is glad, however, that he doesn't try to bring them inside to clutter up the house.

TOOLING UP FOR SOIL CONSERVATION

(Continued from p. 116)

ventional equipment. Some are shovels attached to standard terracer blades that cut a furrow and spread the spoil bank in one operation. Others are modifications of standard listers with the moldboard or the the wings of the share removed or cut. Sometimes damming devices are attached to these same furrowers. For use in heavy sod, a contour furrower has been developed that cuts the furrow without disturbing the sod. This implement is made in a reversible model.

In the field of irrigation agriculture, new machines save soil and water. For orchard use, among the most promising are those for constructing broad, shallow irrigation furrows. These furrows have numerous advantages over the old narrow V-type in that fewer roots are severed, a better distribution of water is obtained, and erosion damage in the furrows is greatly reduced. Other devices such as disk ridgers are also finding wider application in this work.

Improved nozzles and land leveling devices have helped conserve water and minimize erosion in sprinkler-irrigated areas.

Other new developments and improvements in agricultural equipment have helped make soil conservation farming easier, cheaper, and more practical. The increasing use of pneumatic tires and power-controlled implements has simplified the maintenance of permanent grass in waterways and other vital areas. Improvements in electric fencing have made it easier to control and defer grazing. Light, maneuverable tractors with adjustable hitches have facilitated farming on the contour and on small, odd-shaped fields. Stronger spreaders have advanced the use of marl; and other machines, such as the V-bottom trucks equipped with spreaders, have made liming easier and cheaper.

The list could be extended indefinitely. Progress is so rapid that it is difficult to keep abreast of the products of the American genius for invention and gadget-making that have an application in conservation farming. The development of farm equipment is following close on the heels of the conservationists. Whenever there is a new need or a new practice that will help in the husbanding of farm resources, American craftsmen will, as they have in the past, make a machine that will do the job. With the help of equipment manufacturers and agricultural technicians, the American farm plant is tooling up for whatever demands the future may thrust upon it.

Separating Bermuda grass roots from soil with new type shaker.

CAN FARMERS AFFORD TO GROW THEIR POWER?

At the Percheron Judges and Breeders Conference at Frederick, Md., July 21–22, 1941, Professor Ensminger of Massachusetts State College put the question as to what profitable market there may be for the 40,000,000 acres of cropland formerly used to feed the horses now displaced by automobiles, trucks, and tractor. His question can be answered, temporarily at least, by pointing to the increased demand for food in our defense program; and certainly a lot of those acres that were being plowed needed to be put to some less intensive use such as the growing of grass or trees. Professor Ensminger also commented on the scarcity of convincing information on the subject and cited the results of actual farm studies by the Illinois and Iowa Agricultural Experiment Stations.

The financial aspects of this change to tractor farming in these two Corn Belt States are favorable to home-grown power. This is borne out by Farm Security findings in Fayette County, Iowa, in connection with administration of tenant purchase loans: On 15 farms averaging slightly more than 100 acres there was a difference of 91 cents per acre between gross income and operating costs in favor of the use of horses.

Over a 10-year period in Illinois, on 6 tractor-operated farms averaging 171 acres, the total cash expenditures for farm power and machinery amounted to $2,850. On another group of 6 similar farms averaging 163 acres, but horse-power operated, cash expenditures were only $1,190. The difference of $1,660 over the 10-year period amounts to an average of $1.02 per acre annually in favor of the use of horses.

Obviously, horses must continue to play a part of national importance in doing our farm work, and in making use of the greater production of pasture and meadow crops necessary in soil conservation. Horses help in teaching boys to appreciate livestock; they are a source of recreation. What is more, these well-loved animals will continue to serve in the Army for the defense of democracy.

Professor Ensminger's address appears in the September 1941 issue of *The Cattleman*.—A. T. Semple.

BOOK REVIEWS AND ABSTRACTS

by Phoebe O'Neall Faris

SOIL CONSERVATION DISTRICTS IN ACTION ON THE LAND. By Glenn K. Rule. U. S. Department of Agriculture Miscellaneous Publication No. 448. Washington, D. C. July 1941.

The Service collaborates with soil conservation district supervisors to produce this bulletin showing vividly how the farmer-does-it-himself idea has worked out on the land after 4 years of energetic effort. Study and planning and effort, one should say; because there has been a great deal of getting together on the part of more than a million and a half farmers with State and Federal and local technicians for intensive areal studies so that soil conservation through these local governmental units might be successful and permanent.

Mr. Rule uses the device of the specific example to show how and why, within so short a time, the soil conservation districts have spread over a quarter of a billion acres of American farm land, to show how these districts function, and what they mean to the future of our country. Out of 450 districts he has chosen two, very far removed from each other, for detailed description. One is a goodly slice of the State of North Dakota; it is called the Cedar Soil Conservation District. The other is 'way down in the Cotton South—the Terre Rouge-Bodcaw District in southwestern Arkansas—over a million acres of cotton land, timber, lakes, streams, roads, and towns. As told by Mr. Rule the story of farmers "doing it themselves" in these two immense blocks of land is intensely interesting because it shows the people on the land taking advantage of an opportunity to change farming systems and incorporate conservation methods and practices. The fine illustrations help greatly to point up the story. It is to be hoped that this bulletin will be widely distributed.

COMMERCIAL FERTILIZERS, THEIR SOURCES AND USE. Third edition. By Gilbeart H. Collings, Philadelphia, 1941.

Every year, every season, farmers of this country realize more keenly that they cannot use soil-fertility materials by the guess-and-hope-for-the-best method. This third edition of an important book, following within three years the second edition, is one more "sign of the times" and the rapid progress in all problems concerning fertilizers and their use in securing larger yields of field and nursery crops. Much new material is now included to aid plant nutrition specialists, and as helps to growers in understanding the necessity for replacing plant nutrients lost through cropping, leaching, and erosion.

Aside from its wealth of practical information on availability and uses of commercial fertilizers, the book now can be said to be built around the thesis of our own needs in the matter of plant nutrients: Can the United States ever become self-sufficient in its fertilizer requirements? Can our soils be restored, while we grow and harvest tremendous amounts of food and feed crops, and kept thereafter in a high state of fertility to meet growing demands on the land?

Judging from Professor Collings' account of the origin and development of the use of commercial fertilizers, the industry in its early days consisted chiefly of digging up great parts of the planet's "skin," transporting them across broad oceans and mixing them with other parts. Today the situation is changed; world production and reserves of fertiiizer materials are being estimated; consumption rates are receiving attention; experts begin to talk of a saturation point for fertilizers. It seems that there is, or ought to be, such a thing as conservation of soil-fertility materials as well as of soils.

Thus, particularly because of production trends in the United States as related to conditions in other countries, it is most important that users of fertilizers know what they are using and have more than general knowledge of the effects upon plant growth and soils. For the student's convenience, Professor Collings has arranged the essential nutrient elements taken from the soil, other than nitrogen, phosphorus, and potassium, into two groups. In this edition he includes a new chapter on the manufacture and use of the ammonia solutions.

The nitrogen carriers are treated in great detail as to sources and relative values for field crops. The "synthetics" are given a complete chapter, with information as to how they are manufactured, their uses when applied to crops, their characteristics in storage and transportation, their effect upon the soil, their uses other than as soil-fertility materials, how to apply them and the precautionary measures to observe before applying.

The author also gives especial attention to the rarer essential nutrient elements required by field and horticultural plants. Two long chapters present the principles underlying the purchase and use of fertilizers, and directly following are some practical directions for applying fertilizers for special purposes—germination, seedling growth, for economical yields, for fish ponds. The book has both an author index and a subject-matter index, so that with the extensive bibliography as further aid, the person using it either as a text or as a reference has no difficulty in finding quickly the information needed, or in checking the many different commercial fertilizers as to source, availability, uses and application methods.

METHODS OF ANALYSIS OF THE ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS. Fifth edition. Washington, D. C.

This valuable "Book of Methods" keeps up to date in a changing world, thanks to the vigorous, now famous, association from which it first emanated some twenty years ago. The handbook now contains over 750 pages—a far cry from the 30 printed pages of its first issue.

The volume opens with methods of soils analysis and follows up with fertilizers and agricultural liming materials. Chapter 11 gives official and tentative directions for sampling and analyzing plants for the various chemical constituents, while a chapter farther on—chapter 27 to be exact—is devoted to methods of analyzing grain and stock feeds for moisture, ash, proteins, nitrogen, fat, minerals, etc. Two chapters contain microbiological and microchemical methods. Chapters 3 and 5 are left blank to be inserted in another edition, probably, after the Association has studied "Sewage" and "Agricultural Dust."

The large part of the handbook is given over to official and tentative methods of analyzing specific agricultural products. Foods and drugs are extensively treated. The 25 reference tables included at the end of the methods are indispensable in the chemical laboratory.

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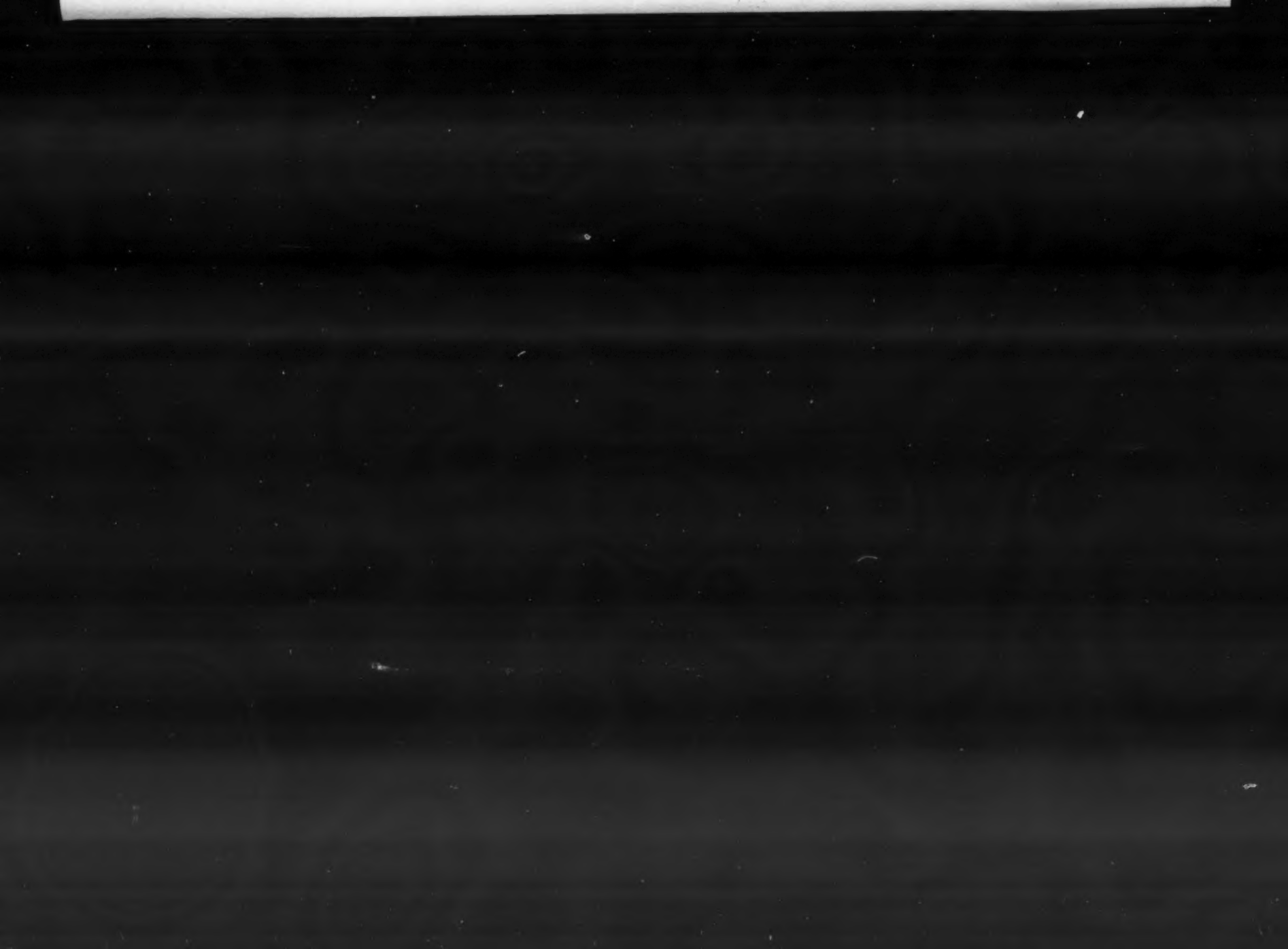

For REFERENCE

Compiled by ETTA G. ROGERS, Publications Unit

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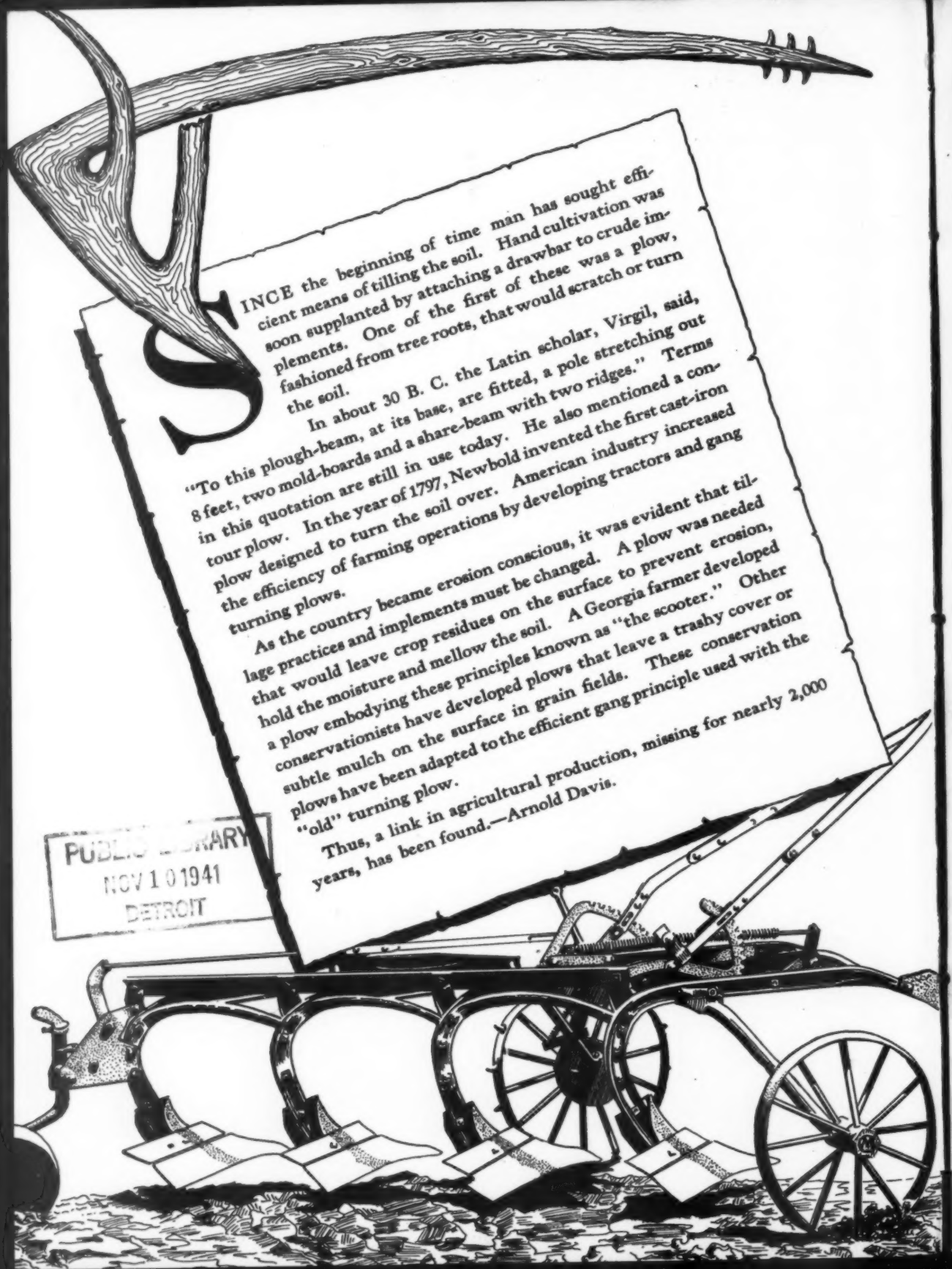
[1] Prepared solely for use by the Soil Conservation Service and official cooperators.

[2] From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.



SINCE the beginning of time man has sought efficient means of tilling the soil. Hand cultivation was soon supplanted by attaching a drawbar to crude implements. One of the first of these was a plow, fashioned from tree roots, that would scratch or turn the soil.

In about 30 B. C. the Latin scholar, Virgil, said, "To this plough-beam, at its base, are fitted, a pole stretching out 8 feet, two mold-boards and a share-beam with two ridges." Terms in this quotation are still in use today. He also mentioned a contour plow. In the year of 1797, Newbold invented the first cast-iron plow designed to turn the soil over. American industry increased the efficiency of farming operations by developing tractors and gang turning plows.

As the country became erosion conscious, it was evident that tillage practices and implements must be changed. A plow was needed that would leave crop residues on the surface to prevent erosion, hold the moisture and mellow the soil. A Georgia farmer developed a plow embodying these principles known as "the scooter." Other conservationists have developed plows that leave a trashy cover or subtle mulch on the surface in grain fields. These conservation plows have been adapted to the efficient gang principle used with the "old" turning plow.

Thus, a link in agricultural production, missing for nearly 2,000 years, has been found.—Arnold Davis.